NFDRS PARAMETERS AND CARRYOVER VALUES

When a station record is created, the input form identifies the key variables, such as fuel model, slope class, staffing variables, and default moisture values, the NFDRS processor utilizes in the calculation of NFDRS outputs for a specific station.

A primary use of the edit form is to modify the fuel moisture values currently being used within the processor to calculate NFDRS outputs. The modification of these carryover fuel moisture values can significantly affect the NFDRS outputs. It is suggested that any changes be coordinated with Agency fire-danger rating experts.

Understanding the concept of the "effective date" and its relationship to data displayed is important for users who are going to manipulate the various fields. The 100-hour, 1000-hour, X1000-hour, herbaceous and woody fuel moisture values shown for the "effective date" are the carryover values from the previous day’s NFDRS computations, and are the values upon which the next day’s fire danger rating calculations are based. The 10-hour fuel moisture value is observed daily, either as a measured or computed value, and is not displayed as a "carry-over" value. The same is true for the 1-hour fuel moisture value that is computed daily from observed weather variables.

The following is a discussion of carryover values and NFDRS parameters and some useful tips and guidelines to be considered if and when changes are made. Certain data are only required for the 1978 fuel models, while others are only required for the 1988 fuel models.

Priority (PRI) - This field identifies the priority in which the fuel model(s) are assigned to this station. It is also used to differentiate between fuel models listed in the station catalog or record. The order listed is important as certain elements discussed later are keyed off of this list.

On initial entry, default fuel moisture values for the 100-hour, 1000-hour, and X1000-hour fuel moistures are set in the fire danger rating processor according to the climate class of the Priority 1 fuel model. NFDRS parameters may be defined for up to four fuel models (fuel model, slope class, grass type, climate class combinations).

Identification (ID) - This field identifies the fuel model set(s) being used for danger-rating calculations. The NFDRS processor will accommodate both the 1978 and 1988 fuel models. A 7 or 8 is added to the alphabetic fuel model to designate the set of fuel models being utilized; for example 7C would indicated the 1978 version of fuel model C and 8G would indicate the 1988 version of fuel model G. The 1978 and 1988 fuel model sets may be run simultaneously at the same station.

There are differences in the inputs, the outputs, and how the danger rating processor deals with live fuel moisture between the 1978 and 1988 fuel models. More classes of fuels are passed between the live and dead categories in the 1988 fuel models than the 1978 fuels models. The 1988 fuel models account for seasonal mid-flame wind speed changes based upon vegetation and reduced burning potential after periods of precipitation at other than scheduled observation times.

Note: Review USDA-Forest Service Research Paper SE-273 for more detailed information on the differences between the 1978 and 1988 fuel models.

Herbaceous Vegetation Stage Code (HS) - This field describes the general condition of the herbaceous vegetation in the 1978 fuel models for the area represented by the danger rating station. The following is a discussion of coding used in describing the herbaceous vegetation stages.

PREGREEN - A "P" describes the vegetative state that exists in late winter before new growth appears. PREGREEN is the default herbaceous vegetation stage code when a new station is created. It also becomes the default value if there has been a break in the data of at least 30 days. The herbaceous fuel moisture is set equal to the 1-hour fuel moisture in the PREGREEN stage.

GREEN - A "G" signifies the start of the season that the herbaceous plants are reacting to improved growing conditions. This is usually once a year in the spring though several GREEN conditions per year are possible in drier climates. The herbaceous fuel moisture in the green stage ranges from 120 to 250 percent and the total loading of the herbaceous fuels is in the live fuel class.

The length of the green-up period (the initial period after model is activated with the "G" code) in the fire danger rating processor is set by the climate class, which is discussed in detail later. One, two, three, or four weeks (or seven times the climate class expressed in number of days) is used to correspond to climate class 1, 2, 3, or 4.

Climate Class	Length of Green-up Period
1	7 days
2	14 days
3	21 days
4	28 days

Two important actions occur in the fuels models during the "green-up period". First the herbaceous fuel load is transferred from the 1-hour timelag [dead] category to the live herbaceous category at a rate established by the climate class, and secondly, the herbaceous fuel moisture is increased from its PREGREEN, CURED or FROZEN value to a value dependent on environmental conditions both before and during the growing season.

Typically, herbaceous moisture will be somewhere near or at 250 percent at the completion of green-up. If the conditions prior to and during the growing season are dry or if a late "green-up" is experienced, the herbaceous moisture will generally peak at a lower value. If it has been exceptionally dry during the green-up period, the modeled herbaceous fuel moisture may not reach 120
percent by the end of the "green-up period", and as a result, the GREEN stage is bypassed and the model goes directly into the TRANSITION stage.

NOTE: It is important to calculate NFDRS outputs daily for 30 days prior to and throughout the entire "green-up period" to ensure that the herbaceous and woody fuel moisture models function properly.

See Appendix H in USDA-Forest Service General Technical Report INT-39 for further information on climate classes.

TRANSITION - A "T" is used to indicate that fuels are in a state of transition when the range of herbaceous fuel moisture is between 30 and 120 percent. During TRANSITION, the live perennial herbaceous fuel load is being passed back and forth between the 1-hour timelag live and dead fuels. The movement between classes is controlled by environmental conditions that affect the live fuel moisture content of the plants. Transition is a calculated vegetation state that is keyed off of the herbaceous fuel moisture values.

For annual herbaceous plants, the transition process differs slightly. The annual herbaceous load is not allowed to move back and forth between the live and dead classes - it only transfers from the live category to the dead category, never in the reverse direction as allowed with perennials.

CURED - A "C" is used to signify that herbaceous fuels have reached a "cured state". It is normally entered to over ride calculated values when the herbaceous fuel moisture model in the danger rating processor does not "cure" the herbaceous plants (herbaceous fuel moisture equal to 30%) on a timetable matching the actual phonological curing in the area represented by the station. It is also used to signal the death of herbaceous plants due to cold temperatures when the temperature is not low enough to effect woody plants.

Perennial plants are allowed to recover from the "cured state" and "re-green" on their own if moisture conditions improve. Annual herbaceous plants, however, stay "CURED" until the user declares "GREEN". While in the CURED stage, the herbaceous fuel moisture is equal to the fine dead fuel (1-hour timelag) moisture.

FROZEN - The "F" code is used to signify when cold temperatures have killed herbaceous plants and forced woody fuels into dormancy. While in the FROZEN stage, the herbaceous fuel moisture is equal to the fine dead fuel (1-hour timelag) moisture and the woody moisture is climate class dependent.

See USDA-Forest Service Research Paper INT-226 for more detailed information on the live fuel moisture model utilized with the 1978 fuel model set.

Herb Date - This is the date associated with the CURRENT "Herbaceous Vegetation Stage Code". The fire danger-rating processor WILL automatically change this date when the herbaceous fuel moisture conditions cause the herbaceous vegetation states to shift between stages, i.e. from GREEN (G) to TRANSITION (T) to CURED (C). The user must enter a date to correspond to any changes made manually to the “Herbaceous Vegetation Stage Code.” 78 NFDRS FUEL MODELS ONLY

NOTE: When a GREEN (G) is entered for the herbaceous vegetation state code to signal the start of the "green-up process", the date entered in this field will be known as the “green-up date” for the live fuels associated with the fuel model. The “green-up date” will be automatically displayed in the “Green-up Date” field. The field will be automatically updated to reflect subsequent "green-up dates".

When “green-up” is signaled, the herbaceous fuel moisture increases from its cured, frozen or pre-green value of 30 percent or less (herbaceous fuel moisture equal to the 1-hour timelag fuel moisture), to a green value which is determined by the moisture conditions during the green-up period. Typically the herbaceous moisture will approach a maximum value of 250 percent at the completion of green-up. Given a dry spring or a late green-up date, the herbaceous moisture may peak at a lower value.

The moisture content of perennials is allowed to increase or decrease after “green-up” as available moisture increases or decreases. The moisture content of annuals can only remain the same or decrease once the green-up process is complete.

Green-up Date – This field displays the date that the user declared "green-up" to start for the specific fuel model module. On station initiation, the value defaults to the date equal to the date that a "G" is entered.

Shrub Type Code (SB) - The shrub type code controls the static or dynamic nature of the live woody fuel loading in the 1988 NFDRS fuel models. If the evergreen option is selected, the live woody load remains constant (static) at all live woody fuel moisture values. If the deciduous option is selected, the live woody load is transferred (dynamic) between the live woody class and the fine dead fuel class. T he user identified shrub codes are:

D - Deciduous (dynamic)
E - Evergreen (static)

The transfer between classes is a function of the live woody greenness factor, a required user input. When the live woody (shrub) greenness factor is 0, all live woody load is transferred to the fine dead fuel class. When it is 20, the live woody load is at its fully assigned value for the fuel model, and the fine dead load is correspondingly reduced. That portion of the live woody load not moved to the fine dead class remains in the live woody loading.

When using the 1988 fuel models, the user must also select the prevalent type of shrub cover (woody plants) for the area represented by the weather station. The evergreen mode should be selected if the live shrubs are not deciduous or if the user desires to not have the live fuel load transferred between the live and dead classes.

The Deciduous Shrub Code also combines with the Season Code, another required user input, to control the variable wind adjustment factor in the 1988 fuel models. The wind adjustment factor varies seasonally when the live woody vegetation is designated to be “deciduous”. The adjustment factor, which adjusts wind speed for availability of foliage, is set to its maximum value during the winter. This provides for the minimum mid-flame wind speed adjustment.

During the spring it decreases, and during the fall it increases, as a function of the woody greenness factor. During the summer it is set to its minimum values. The wind adjustment factor is held constant all year if the live woody vegetation is designated to be “evergreen”.

Slope Class Code (SLP) – Use this field to represent the average slope class in the vicinity of the weather station, an area of special concern, or a protection area. The codes representing the average slope expressed as a percent in the area represented by the station are:

1 - 0 - 25%
2 - 26% - 40%
3 - 41% - 55%
4 - 56% - 75%
5 - greater than 75%

The classes are structured such that the effects of slope double as the next higher slope class used. For example slope class 2 will have 2 times the effect as slope class 1 and slope class 3 will have 2 times the effect as slope class 2. In other words a slope class 5 will have 16 times the affect as a slope class 1 when all other factors are equal.

Grass Type Code (GRS) - Correctly designating the lesser vegetation in the fuel model as "annual" or "perennial" is extremely important. The live fuel moisture model will predict faster drying and curing rates for annuals than for perennials. If more than half of the herbaceous plant cover in the represented area is made up of annual plants, designate them as "annuals", otherwise they are "perennials". The "annual" grass type is seldom appropriate in mountainous areas or east of the 100th Meridian.

A - Annual
P - Perennial

NOTE: Fuel Model A must be given an annual grass type designation and Fuel Model L must be given a perennial designation.

Climate Class Code (CLI) - The purpose of the climate class is to provide the broad-scale plant moisture responses needed for rating fire danger. Climate class is used to define different linear drying rates for annuals, perennials, and woody plants. Within a particular climate class, a single drying rate is assumed for woody plants. In live herbaceous plants, the drying rate varies in two stages: the GREEN (1978 models) or SUMMER (1988 models) when the herbaceous fuel moisture exceeds 120 percent, and the TRANSITION (1978 models) or FALL (1988 models) when the herbaceous moisture ranges from 30 to 120 percent. In the GREEN /SUMMER phase annuals and perennials dry at the same rate, but in the TRANSITION /FALL phase annuals exhibit faster drying rates than perennials.

The length of the green-up period is scaled to the climate class because plants growing in drier climates typically respond quicker to favorable growing conditions than do plants in wetter climates.

While the United States can be divided into many climatic zones, four general zones have been selected to meet fire danger rating needs. The climate class should be selected that corresponds to the location of the weather station being used. The following classes are used in NFDRS:

1 - Arid / Semiarid
2 - Sub-humid (rainfall deficient in summer)
3 - Sub-humid (rainfall adequate in all seasons) / Humid
4 - Wet

The specific climate class selection in the initial station set-up mode sets default values for the herbaceous fuel moisture, woody fuel moisture, the X-1000 variable, and the 100-hour and 1000-hours timelag fuel moisture values. The 100-hour and 1000-hour timelag defaults values were set by the climate class identified with the Priority 1 fuel model module.

The following default values were set when the station was originally cataloged.

CLI	Herb FM	Woody FM	X-1000	100-hr	1000-hr
1	30	50	15	10	15
2	30	60	20	15	20
3	30	70	25	20	25
4	30	80	30	25	30

The climate class is also a variable used in the fuel stick aging computation.

See USDA-Forest Service General Technical Report INT-39, pages 51-54 for further information regarding selection of climate class.

Herbaceous Fuel Moisture (Herb FM) - This calculated value represents the moisture content expressed as a percent of oven-dry weight of the herbaceous fuels (plants that grow from the base or from seed each year, such as grasses, forbs and ferns). These fuels are in the 0 to 1/4-inch size class. The herbaceous fuel moisture is a function of the X-1000 value (described latter), the herbaceous plant type and the NFDRS climate class.

During spring green-up, the live herbaceous fuel moisture increases gradually from the default 1-hour timelag fuel moisture value. If a second green-up occurs during the growing season, the X-1000 value is set equal to the 1000-hour timelag fuel moisture and the herbaceous fuel moisture increases from its current value rather than from the 1-hour timelag fuel moisture value.

See Appendix H in USDA-Forest Service General Technical Report INT-39 and USDA-Forest Service Research Paper IN-226 for additional information.

Woody Fuel Moisture (Wood Fm) - This calculated value represents the moisture content expressed as a percent of oven dry weight of the foliage and small twigs of woody perennial plants (reproduction of either conifer or broadleaf tree species, and shrub or brush species, evergreen or deciduous). The woody fuel moisture is a function of the 1000-hour timelag fuel moisture and the climate class. The basic moisture computation is the same in the 1978 and

1988 fuel models, however in the 1988 models, the value is further refined through the use of the shrub greenness factor.

The live woody load in the 1978 fuel models and in the evergreen option of the 1988 fuel models is not transferred between the live and dead fuel classes as they are in the herbaceous fuels. If the deciduous option is selected with the 1988 fuel models, the live woody load is transferred between the live woody class and the fine dead fuel class as a function of the shrub greenness factor.

The woody fuel moisture in the 1978 fuel models does not respond to the CURED stage declaration, if and when entered by the user, as does the herbaceous fuels. The woody fuel moisture will "recover" from its dormant or minimum value (the value as set by the climate class) with the addition of moisture without "green-up" being signaled. Entry of the FROZEN herbaceous state is needed to maintain the woody fuel moisture at its PREGREEN value.

A default value will be set on the initial entry for each fuel model that is dependent on the climate class identified for that specific model.

X-1000 - The X1000 value is the live fuel moisture recovery value. It is an independent variable in the calculation of herbaceous fuel moisture. It is a function of the daily change in the 1000-hour timelag fuel moisture, and the average temperature. Its purpose is to better relate the response of the live herbaceous fuel moisture model to the 1000-hour timelag fuel moisture value. The X-1000 value is designed to decrease at the same rate as the 1000-hour timelag fuel moisture, but to have a slower rate of increase than the 1000-hour timelag fuel moisture during periods of precipitation, hence limiting excessive herbaceous fuel moisture recovery.

A default value, which is equal to the default 1000-hour value, is set on the initial entry for each fuel model module. The default value is dependent on the climate class identified for that specific module.

With the 1978 fuel models, when a second "green-up" is declared, the X-1000 is set equal to the 1000-hour timelag fuels. The X-1000 value can vary between fuel models at the same station.

NOTE: Weather observations must be stated 3 to 4 weeks prior to the onset of green-up to assure that the 1000-hour timelag fuel moisture, and associated X-1000 have stabilized at a reasonable value for the current weather conditions.

Staffing Index Breakpoints. Managers normally utilize fire danger information as guidelines in fire preparedness, staffing, dispatching, or prevention related decisions. Each type of decisions requires a different set of fire danger rating information to deal with needs specific to that problem or task. The individual characteristics of each NFDRS component or indices allows them to be matched with the needs of decisions or the fire problem being addressed. The breakpoint feature provides fire managers the flexibility to select the indices or component they want to use and group NFDRS outputs into classes that can serve to guide daily decisions.

Note: FIRES is a computer program that enables the user to correlate fire activity and NFDRS outputs to assist in making better fire management decisions.

Staffing Index Code (SI) - The characteristics of the individual "staffing index" are such that their suitability varies with the type of fire management problem or task being defined. The user must decide both the staffing index they want to use and the fuel model/slope class combination representative of the area of their problem. More than one staffing index may be selected for use with a particular fuel model at a station, but each requires a separate line entry.

The following is a brief discussion of the characteristics of each of the NFDRS outputs:

Burning Index (BI) - Highly sensitivity to the fuel model. Low to moderate memory. Moderate variability. Low predictability. Fair to good characterization of the fire season.

Energy Release Component (ERC) - Very high sensitivity to the fuel model. Moderate to good memory. Low variability since it is not affected by the wind. Good predictability. Fair to good characterization of the fire season.

Fire Load Index (FLI)- Moderate sensitivity to the fuel models. High memory. High variability. Moderate predictability. Poor to fair characterization of the fire season.

Ignition Component (IC)- Moderate sensitivity to fuel models. Very short memory as it is dominated by the 1-hour timelag fuel moisture. Highly variable due to affects of relative humidity and wind speed. Very low predictability. Very poor characterization of fire season.

Keetch-Byram Drought Index (KBDI)- No sensitivity to fuel models. Good memory. Moderate variability. Good predictability. Good characterization of the fire season potential.

Lightning Caused Occurrence (LOI) - Moderate sensitivity to the fuel model. Very short memory. High variability caused by relative humidity and wind. Very low predictability. Very poor characterization of fire season.

Human Caused Occurrence (MOI)- Moderate sensitivity to fuel models. Very short memory. High variability caused by relative humidity and wind. Very low predictability. Very poor characterization of fire season.

Spread Component (SC) - Very high sensitivity to fuel models. Very short memory dominated by surface area weighting and the 1-hour timelag fuel moisture. High variability due to relative humidity, wind, and live fuel moisture. Low predictability. Very poor characterization of the fire season.

Display Class (DC) - The number of different decision options that are likely to be considered when addressing a particular situation affects the number of display classes you should choose. For example if it is a yes or no decision, you only need two display classes. On the other hand, if you have five different dispatch response levels possible, you need five display classes. The number of classes can range from 3 to 9. The number of display class may vary by the staffing index to which they are applicable.

Staffing Index Percentile Values (SI% - Low/High) - The staffing index values, commonly referred to as the breakpoints, are utilized to stratify NFDRS outputs into meaningful groupings to assist in applying them to fire danger rating related decisions. The numbers represent the percentile level for the particular indices or component as well as the actual numeric value that the user wants to break their high and very high conditions at respectively. Agency policy often sets the breakpoint percentile values. The Forest Service for example uses the 90/97 percentiles as their standard breakpoints while the Bureau of Land Management uses 80/95. Using the Forest Service standard, 90% of the historic days have had a fire danger rated High or lower and 97% have had fire danger rated Very High or lower.

Use of standard values associated with the percentile breakpoints is appropriate for decisions to be applied across large areas where differences between units need to be recognized. Local decisions should use locally developed breakpoints. Site specific low and high percentile breaks and associated values, other than Agency required values, should be entered only after analyzing historic fire weather data using the FIREFAMILY program or PCFIRDAT.

The staffing index percentile values guide in the determination of the staffing levels (SL) and the adjective fire danger-rating (R) displayed as part of the NFDRS outputs.

Carry Over Values - Carryover values are products of calculations done within the NFDRS processor. Monitoring these values and adjusting them as appropriate is a critical part of the fine tuning the NFDRS to fit local conditions.

100-HR – The 100 hour fuel moisture value represents the modeled moisture content of dead fuels in the 1 to 3 inch diameter class. It can also be used as a very rough estimate of the average moisture content of the forest floor from three-fourths inch to 4 inches below the surface. The 100-hour timelag fuel moisture is a function of length of day (as influenced by latitude and calendar date), maximum and minimum temperature and relative humidity, and precipitation duration in the previous 24 hours. Values can range from 1 to 53 percent.

A default value, based on the climate class of the priority #1 fuel model module, will automatically be entered in this field if there is a break of 30 days or more in the observations entered.

See USDA Forest Service General Technical Reports INT-169 and PSW-82 for additional information.

1000-HR - This value represents the modeled moisture content in the dead fuels in the 3 to 8 inch diameter class and the layer of the forest floor about 4 inches below the surface. The value is based on a running 7-day average. The 1000-hour timelag fuel moisture is a function of length of day (as influenced by latitude and calendar date), daily temperature and relative humidity extremes (maximum and minimum values) and the 24-hour precipitation duration values for a 7-day period. Values can range from 1 to 141 percent.

A default fuel moisture value, based on the climate class of the priority #1 fuel model module, will automatically be entered in this field if there is a break of 30 days or more in the observations.

See USDA Forest Service General Technical Reports INT-169 and PSW-82 for additional information.

<u>Measured Woody Fuel Moisture</u> - The user may enter a locally measured woody fuel moisture for each station. This value will override the modeled woody fuel moisture value in the fire danger rating processor for a period of 30 days.

NOTE: This is a special purpose feature reserved for those locations that actually collect and measure fuels samples of living branch wood and foliage. The purpose of this measurement is to tune the internal calculation of the woody vegetation moisture content.

IF ACTUAL FUEL MOISTURE MEASUREMENTS ARE NOT MADE, DON'T USE THIS FEATURE.

<u>Woody Measured Date</u> - Identifies the date the woody fuel moisture was measured. The measured woody fuel moisture value is used in danger-rating calculations for 30 days from the woody measured date. If another measurement is not entered within the 30day period, a message is printed for 5 days warning of the "stale wood data". After this period, the program will compute the woody fuel moisture internally without considering the old measured value.

<u>Fuel Stick Date</u> – This feature is no longer a requirement of the NFDRS. Research has found that the weathering of fuel sticks had little affect on the NFDRS outputs. In the original NFDRS calculations, a correction was added to the observed 10-hour fuel moisture stick values to offset the loss of weight associated with weathering effects. The adjustment was a function of the number of days since the sticks were set out and the climate class. The computation resulted in a rapid rate of weight loss after the first month of exposure and then the rate decreases with exposure time. The weight loss adjustment is less for dryer climates than moist climates.

See USDA-Forest Service General Technical Report INT-169, and USDA-Forest Service Research Paper NC-154, for additional information.

Stick Age – This was a record keeping feature of the original NFDRS processor that is no longer applicable since the fuel stick aging algorithm has been removed from NFDRS processors. It recorded the number of days that had passed since the fuel stick was last changed. The value was used in the computation of the aging correction factor applied to the observed fuel stick value.

<u>THE FOLLOWING APPLIES ONLY TO THE USE OF THE 1988 FUEL MODELS.</u>

The information can be optionally entered for the 1978 fuel models without affecting NFDRS outputs.

1 HR = 10 HR – This is a yes/no entry. This feature was added in an attempt to fine tune the way the 1978 fuel models responded after rainfall events. The effect of setting the 1-hour timelag fuels equal to the 10-hour timelag fuels is to produce higher fine dead fuel moisture values, after rainfall events and reduce the overrating of fire danger inherent to the 1978 fuel models, especially if strong winds or low humidity occurred after a frontal passage.

When fuel moisture sticks are not used in conjunction with the 1988 fuel models, the fine dead fuel moisture is calculated as a function of the 1-hour and 100-hour timelag fuel moisture, and observed dry-bulb temperature and relative humidity. Use of the 100-hour timelag fuel moisture provides a mechanism for including the effect of precipitation events that do not occur at observation time.

If the user selects the 1988 fuel models but does not set the fine fuel moisture equal to the 10-hour timelag fuel moisture, the danger rating processor will still do so on the day of and the day following a precipitation event of more than 0.1 inches. This reduces the tendency to over rate fire danger after precipitation. Otherwise the dead fuel moisture calculation is not affected.

Season Code – The use of the 1998 fuel models requires the use of greenness factors described below. The season code defines which of the live fuel moisture calculations to use. It should be changed periodically during the year. The following are the Season codes applicable to the 1988 fuel models:

Winter – Use WINTER to reflect the winter-like season when herbaceous plants are dormant. The climate class determines the dormant season woody fuel moisture and the live herbaceous fuel moisture is set to equal the fine fuel moisture. (This is a similar approach as used in the PREGREEN and FROZEN herbaceous conditions in the 1978 models.)

Spring – Use SPRING to reflect the time period between when the herbaceous plants or shrubs first begin a new season's growth until the herbaceous plants complete their spring growth flush.

Summer – Use SUMMER to represent the season from when the herbaceous plant growth is completed until the shrubs begin to show signs of fall curing.

Fall – Use FALL to represent the season between the time that the deciduous shrubs begin to lose their leaves, or evergreen shrubs begin to enter dormancy until the shrubs and herbs are fully dormant

Greenness Factor - GRASS/SHRUB - The 1988 fuel model set requires user's to enter greenness factors for BOTH the live herbaceous (grass) and live woody (shrub) fuel components. This feature permits the user to control each greenness factor independently. The greenness factors represent the actual greening and curing of the two components. The greenness factors for herbaceous plants and for shrubs do not have to be the same.

The greenness factors represent a subjective visual estimate of the current general greenness of herbs and grasses, and shrubs, compared to their maximum greenness. They provide the NFDRS user an opportunity to realistically reflect actual conditions. The greenness factors range from 0 to 20, where 0 represents fully cured herbaceous plants and dormant shrubs, and 20 represents a condition in which the herbaceous plants and/or shrubs are as green as they ever get. The greenness factors are independent of climate class; they range from 0 to 20 for all climate classes.

As the herbaceous plants and shrubs green in the spring, increasingly larger greenness factors are entered for each. It is not necessary to increase the greenness factor by one each day. If the greening is progressing slowly, the same factor may be entered for several consecutive days. If the greening is rapid, the greenness factors may be increased by more than one per day. It is important to avoid large changes and avoid vacillating between increasing and decreasing values over short time periods.

The curing of the herbaceous plants and woody shrubs is handled in just the reverse of the spring greening; the greenness factors are decreased gradually as curing progresses.

The greenness factors also provide a mechanism for reflecting the effect of summer droughts. If a drought becomes so severe that the herbaceous plants begin to cure and the shrub leaves wilt, the grass (herb) and shrub (woody) greenness factors can be reduced appropriately. If the drought is later broken, the greenness factors can be increased to reflect increased moisture. These types of changes should be made gradually to reflect what is actually occurring in the fuel type. KBDI values can be used to guide in the setting of the greenness factors during drying periods.

Keetch-Byram Drought Index (KBDI) - This index is based on annual precipitation, daily precipitation and maximum daily temperatures in excess of 50 degrees Fahrenheit. The numeric value of the index is the amount of precipitation measured in 1/100th inches needed to bring the soil back to saturation. It is used to estimate the deep drying of duff and litter and the subsequent availability of additional fuels that could be consumed in the flaming front of a fire. KBDI may be calculated for EITHER the 1978 or 1988 fuel models.

The 1978 fuel models lack the ability to simulate increased fuel availability as drought conditions worsen. The 1988 models have been modified to include a “potential dead fuel load” that can be added to the fuel model as a function of the KBDI therefore KBDI calculations are required if you are using the 1988 fuel models. The added fuel is distributed in proportion to the pre-drought dead fuel loads, with depth increased to preserve the packing ratio.

The total dead load increases above the threshold KBDI value of 100 and the total potential dead load is realized once the KBDI reaches 800.

See Appendix D, USDA-Forest Service Research Paper SE-38 or USDA-Forest Service Research Paper SE-273 for further information.

Annual Precipitation - The KBDI computation requires the input of the average annual precipitation amount at the weather station. This includes both rainfall and the water equivalent of snowfall. If site-specific year-round precipitation data is not available, a reliable estimate can be obtained from the nearest National Weather Service Office. THIS INPUT IS ESSENTIAL FOR ANY KBDI CALCULATIONS.

The annual precipitation amount is used to control the effective rate of wetting and drying associated with precipitation events. This field can be entered for stations using only the 1978 fuel models to further document conditions at the station and provide the local fire manager with another tool for assessing fire danger.